ATTACH. 3.
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Ø7 December 1971

Indices of COINS Performance

INTRODUCTION:

IT is proposed to develop indices of performance for the COINS system that can be used:

to communicate important aspects of the operational status

to identify points where improvement of the system would be especially profitable

to identify underutilized capabilities of the system

to aid in the allocation of training efforts

The proposed indices are to be formulated in terms of performance data that are readily available and an analysis procedure that is simple to carry out. Each index would be a figure of merit, that is, an arbitrary function of operationally significant quantities, such that the index increases only if one or more of these quantities changes in a desirable direction.

This paper will present proposals for several indices. These proposals are made primarily for conceptual review; it is realized that the reaction of COINS users and experience with data collection and manipulation will show a number of areas in which these proposals will need to be modified or supplemented. To stimulate the process of data collection and the process of iterative improvement of

the indices themselves, it is proposed that experimental versions of the indices be calculated and distributed for user comment.

In order that the indices be maximally useful for monitoring the operation of COINS, several types of questions require to be discussed, and eventually understood in more depth than can be attempted in this paper: what kinds of capability or performance should one try to summarize; what kind of information should be incorporated in the indices and what should be the sources of it; how should each index be formulated as a function of the available input data in order to best serve the development needs of COINS. The answers to these questions suggested here are intended to stimulate this discussion and understanding.

TYPES OF INDEX:

The following types of statistical index are proposed.

file quality. An index for each file of the state of maintenance of information in the file.

service quality. An index for each file and each user of the quality of service being provided in response to requests made against that file taking account of:

system availability

speed of response

quality of response

system useability. An indicator for a given file and user of the degree of success experienced in getting requests against the given file serviced.

average quality. An indicator of the average quality of service available from COINS taking into account the intrinsic quality of the files and of the system performance. This is to be a composite of quality factors that are independent of specific user needs expressed as a fractional quantity between .ØØ and 1.ØØ.

gross capability. An indicator computed separately for each user, of the total value of service available through COINS weighted to take account of quality.

breadth of utilization. An indicator of the number of actual user analysts, weighted by the value of the service they get.

useful output. An indicator of the quantity of service actually furnished to users as measured by number of requests serviced weighted by the quality of that service.

potential breadth of utilization. An indicator of the breadth of utilization that would be realized if all users who could profitably use the type of service available in the system were using it.

potential output. An indicator of the quantity of requests that would need to be serviced if all potential users were making full use of the kind of service provided by the system.

As described below the formulation of these indices is intended to create awareness of the overall state of affairs as regards service quality, file quality, and the numbers of users and requests getting serviced, hopefully in order that these will be improved or increased. The indices of potential are intended to be useful for estimating future system requirements and for indicating areas of major underutilization of COINS. The indices of useability are intended to aid in the allocation of training resources.

INPUT INFORMATION:

The following types of input information are to be compiled on a file by file and user-by-user basis:

1. The intrinsic importance of the subject matter of the files
2. The quality of information actually in the files
3. The number of users and potential users of the files
4. The quality of COINS system service
5. The numbers of requests serviced by COINS

Some of the information needed can be collected directly by the system, some must be obtained through

user evaluations. In principle user evaluations should be based on objective criteria to the extent possible, but that is a major project for the future; in the beginning, user evaluations will have to be subjective ratings. Ratings where used will be on a four point scale; where numerical values are needed for calculating an index, the following system of assignments is suggested:

highest rating = 1.ØØ

second rating = .5Ø

third rating = .25

fourth rating = .ØØ

Specific data to be obtained with their symbolical designators are:

from each user agency:

(1) VU = a rating for each file of the value to the user of the file. This rating should be an overall judgement of the potential value to the user of this file if he were given excellent service and file quality; the rating should be based on the relevance to the user of

geopolitical scope of content of the file

time period covered by file,

scope of file in relation to analytical categories such as order of battle, etc.

relative uniqueness of file as an information source for users in the agency.



As a beginning it seems realistic to suggest that users

rate the file subjectively on a four point scale with steps corresponding to the phrases:

1 = urgently needed

2 = quite important

3 = somewhat important

4 = relatively unimportant

(2) FQ = a rating of file quality as judged by intrinsic criteria, that is criteria of how well the file is prepared and maintained. This should be an overall judgement of:

comprehensiveness and completeness

accuracy

validity

currency of update

The subjective rating should be on a four point scale of quality with steps corresponding to the phrases:

1 = generally excellent

2 = excellent but with significant shortcomings

3 = occasionally useful

4 = poor

(3) PU = an estimate of the number of potential users in the agency for each COINS file.

(4) NU = the number of analysts submitting requests or having requests submitted to the file.

(5) UA = A rating by the user of the usefulness of the answers he gets to requests that are successfully

serviced by the COINS system, expressed as the fraction of the time he gets the information he expected and wanted. We are not concerned with profound questions about usefulness, although these should be investigated; here the question is how well the analyst knows how to get what the system can give him. UA should be estimated on a four point scale of how often the analyst gets what he wants:

1 = almost always

2 = frequently or usually

3 = occasionally

4 = seldom or never

From records of system performance:

(1) System Availability. SA = the fraction of the time during scheduled work hours in which the user's system is available to accept requests on COINS.

See attachment no. 1

(2) Speed of Response. SR = the useful speed of system response taking into account that user work patterns are not geared to instant response. We suggest that the speed index of a response time (TR) be calculated from the function

$$SI = \frac{1}{1 + (TR/1\ hr)^2}$$

and the speed-of-response rating be based on the average

of this speed index over all responses, including "aborts" and queries for which no answer was ever received.

(3) Quality of Response. QR should relate to what fraction of queries receive substantive responses, and what fraction have defective responses, incomplete, redundant, etc. Initially we suggest that SR = the fraction of queries that get substantive responses. Later on other quality factors should be brought into this measure.

(4) System Useability. SU is a judgement of how easily the user can successfully communicate requests to the system. It is affected by request language, message format, and communication procedures. Initially we suggest that SU = the fraction of messages that do not abort "for fault".

(5) NR = the number of requests made of the file

(6) AR = the average number of requests made per user against a given file.

COMPUTATION OF THE INDICES

The indices are to be computed in steps:

1. calculate for each file the components of the index.
2. calculate the index for a single file
3. calculate the composite index for COINS

The various indices to be computed are functions of several intermediate quantities or components. These components will be calculated as data arrays. There is a separate component data array for each agency and for each file. These data arrays are designated VU, FQ, PU, NU, UA, NR, SA, SR, QR, SU, AR, PR. The first 11 of these are arrays of directly collected data referred to above. In addition:

The potential requests PR for a given file and agency is the product of AR and PU.

PROPOSED FORMULATION OF INDICES

Average file quality

IFQ = AVG FQ

The index of average file quality on COINS is obtained by first averaging the user ratings for each COINS file and then averaging these mean ratings over all COINS files.

Index of service quality

Service quality for a given file and user is expressed as the composite of system availability, speed of response, and quality of response. The formulation suggested is

SQ = SA x SR x lesser of QR, UA

Index of average service quality

ISQ = AVG SQ

The average is over all files used by a given user.

Index of average system useability.

ISU = AVG SU

The average useability of the system for all files used by a given user.

Average quality.

IAQ = AVG FQ x SQ

The average is over all COINS files.

Gross capability

IGC = SUM VU x FQ x SQ

Here the sum is over all COINS files used by a given user. The index IGC is an extensive index that grows with the number of files on the COINS system.

Breadth of utilization.

IBU = SUM VU x FQ x SQ x NU

The sum is over all files used by a given user. This formulation of IBU gives equal weight to a user who uses once a day and one who uses once a month. The sum is over all files used by a given user organization.

Useful output.

IUO = SUM VU x FQ x SQ x NR

The sum is over all files for a given user. IUO expreses the output of COINS as the number of requests serviced weighted by the value of service on that file.

Potential breadth of utilization.

IPB = SUM VU x FQ x SQ x PU

IPB is like IBU except that the number of potential users is used.

Potential output

IPO = SUM VU x FQ x SQ x PR

IPO is like IUO except that the number of potential requests PR, defined as PU x AR, is used instead of the number of actual requests.

COLLECTION OF DATA

The collection and analysis of those data based on system logs will be the responsibility of the COINS system manager.

The collection of rating information from the user agencies will be the responsibility of the subsystem managers. These data are to be provided to the COINS system manager on a form provided by the COINS manager having the following structure.

AGENCY _____ for period _____ to _____.

| File Name | Number of Users NU = actual | | | | PU = total potential | | | | VU = Potential value of file to user | | | | FQ = Quality of file information and maintenance | | | | UA = Usefulnes of answers to requests | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| File #1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | |
| File #2 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | |
| etc. | | | | | | | | | | | | | | | | | | | | |